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ABSTRACT

In this preliminary investigation (part of a study of the role of prior knowledge in learning) the views of students about prior knowledge and the importance it has for learning were studied. An effort was made to verify whether the previously proposed model of the concept was congruent with student views. Forty of 120 students at the Open University of the Netherlands returned a questionnaire about prior knowledge beliefs, and 14 of these were selected for in-depth telephone interviews. Experimental interviews were also conducted with 2 of the 26 students who were not able to participate in the study. The students interviewed generally were in agreement in considering that they had an average degree of prior knowledge in the course selected. They were able to recognize the proposed components of prior knowledge, information, experience, and skills. The proposed model seemed feasible from the point of view of the student, although a variable accounting for the effects of time should be introduced into the model. Allowing students to assess their own prior knowledge appeared to be too subjective for research use. Twenty-two figures illustrate study findings. (SLD)

Students' views on prior knowledge

F.J.R.C. Dochy

W.H.L. Steenbakkers

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RESEARCH PROJECT 'PRIOR KNOWLEDGE STATE'.

This research project started from the idea that if the specific prior knowledge state is taken into account, in a modular educational system, students will have the opportunity of following different learning paths in a more efficient way.
The research is directed at a clear definition of the problems and their solutions.

Educational Technology Innovation Centre

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STUDENTS' VIEWS ON PRIOR KNOWLEDGE

OTIC Research Report 3.2

F.J.R.C. Dochy

W.H.L. Steenbakkers

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Summary

Within the framework of the research project on 'prior knowledge' (The role of the prior knowledge state in the learning process of students in a modular system of education, with applications in an interactive electronic learning system), exploratory provisional research was carried out into the views of students on prior knowledge by means of in-depth interviews.
The objective of this project was to verify whether the proposed indexation of the concept (research report 2) was feasible and how the conceptual model related to it could be optimalized for research. Further, we investigated the significance of objectively determinable prior knowledge variables, how courses and course orientation booklets (COBs) are related to prior knowledge according to the students, and what the relation is between the prior knowledge variables, 'education' and 'experience' and studying a particular course.
The report to hand gives an overview of the results of this and an interpretation which may be of influence on further research.

1. The objective of the investigation.

In this preliminary investigation an answer was sought to a number of questions on the views of students about prior knowledge and the importance that prior knowledge has on learning. In concrete terms, this meant we were looking for:
- the differences between perceived prior knowledge and objectively determinable variables of prior knowledge;
- the differences between the opinions of the students about prior knowledge and those of experts;
- insight into the fit of courses to the prior knowledge and experience of the students;
- data on the composition of the COBs and their use by students;
- the relation between prior knowledge (objectively determinable variables) and studying a course (the reasons for it, the degree of difficulty, the perception in respect to prior knowledge, and the COB).

2. Research method.

We used in-depth telephone interviews. This sort of interview uses pre-structured questions with open response options and can be regarded as a qualitative method of research, by Patton (1980) also as 'the standardized open-ended interview'. The method offers a number of advantages for this type of research.
In view of the limited information available on the subject, in particular on the relationship of students to prior knowledge, in this study, preference was given to interviews. It is possible to explore the topic by means of interviews. This, in contradistinction to using written questionnaires, where specific information on expected results is required. It is impossible, under those conditions to carry on asking or to pursue a particular theme in questioning.
The pre-structured question method has been used and it allows fixed formulation of questions and a prescribed order. This gives the interviews more uniformity. As a result, the 'important' elements in respect of 'prior knowledge' from the expert research are examined and the analysis and comparison of research data is encouraged by this.
The choice of open answers is based on the assumption that students do not have a communal reference framework for prior knowledge problems. This makes fixed response options almost impossible. Open answers, on the other hand, give the respondent the option of filling in the answers to the questions himself which is good for the exploration of the research area.
The interview schema was set up by the researcher in keeping

with the objectives and in cooperation with the research group. A draft questionnaire was subjected to critical analysis by four content experts, and was finally discussed in the group. This list of questions was then used during two experimental interviews to obtain a definitive interview schema (see appendix).
The telephone interviews are based on practical considerations; it makes it possible to collect quite a lot of interviews with students in different locations in a short period of time. From the literature it appears that, in a methodological sense, telephone interviews can be excellent rivals with the familiar 'face-to-face' interview (Emans, 1986).

3. Respondents.

120 Open University students were approached as respondents, they were divided among fields such as Economics, Natural Sciences and Social Sciences.
The students were asked if they wanted to work on the project, and if they did, they were to return the enclosed questionnaire with data on their personal background, education and work experience.
It was determined beforehand what criteria a student research population would have to meet with the object of selecting two equivalent groups, one with a good deal of prior knowledge and another with little prior knowledge. The hypothesis that students with broad experience and good previous education (university/polytechnic) would have more prior knowledge and those without the education and work experience little prior knowledge, was the starting point for this choice.
The students were between 18 - 45 years of age. All the students had taken one or more courses at the Open University.
The students were equally distributed in terms of level;

- 60 students below polytechnic level (HBO).
- 60 students with polytechnic/university level.

Of the students approached, only those students participated who were involved in a course and had taken more than five learning units of the course.
Further, the students were selected on the basis of their work experience, in combination with their level of education; in this way a High Knowledge groups and a Low Knowledge group were established.
- Less than 10 years work experience and lower than polytechnic level (group 1=LK).
- More than 10 years work experience and polytechnic/university level (group 2=HK).

Of the 120 student who were approached to participate in the research, 40 returned the questionnaire. From among these 40, 14 students were selected for a telephone interview on the basis of their work experience and their level of education. Seven students with a lower than university/polytechnic level and with less than 10 years work experience.

From among the 26 students who were not able to participate in the study two were selected for an experimental interview. The experimental interviews took place with students who were closest in terms of working experience and educational level to the selection criteria of the research population.

4. Results.

4.1. Objective and motives of the student.

The objective and motivation for taking a particular course at the Open University resides primarily as far as the research population of the Open University is concerned in the acquisition of a diploma for a particular course of study or it is among their personal interests. Figure 1 shows the connection, the chance of a better job and other reasons. Comparison between the Low Knowledge (LK) group and the High Knowledge (HK) group reveals two clear differences (figure 2): the HK group seems to study for the diploma and the chance of a better job does not arise as a reason for their study.
Students in the LK group follow OU courses because they are interested, to improve their chance of a better job; because they needed a diploma or because they did not complete some previous training. There appear to be clear distinctions between the reasons why HK/LK group students take courses of the OU.
HK group students try to follow a diploma line where as the LK group students want to improve their chances on the job market and complete studies that they have been unable to in the past.

Figure 1:
Comments of OU students on the objective/motivation for a course.

1. interest
2. work
3. diploma
4. no choice
5. previous education

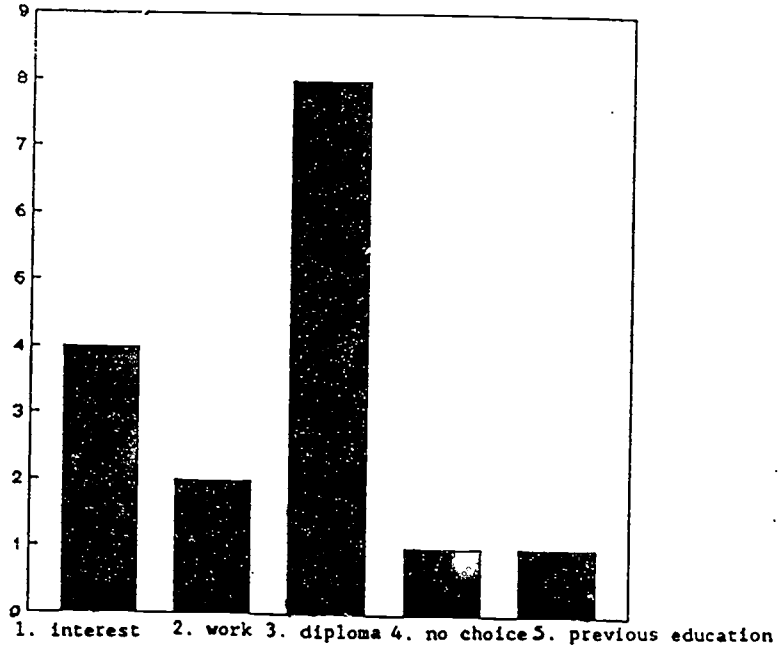
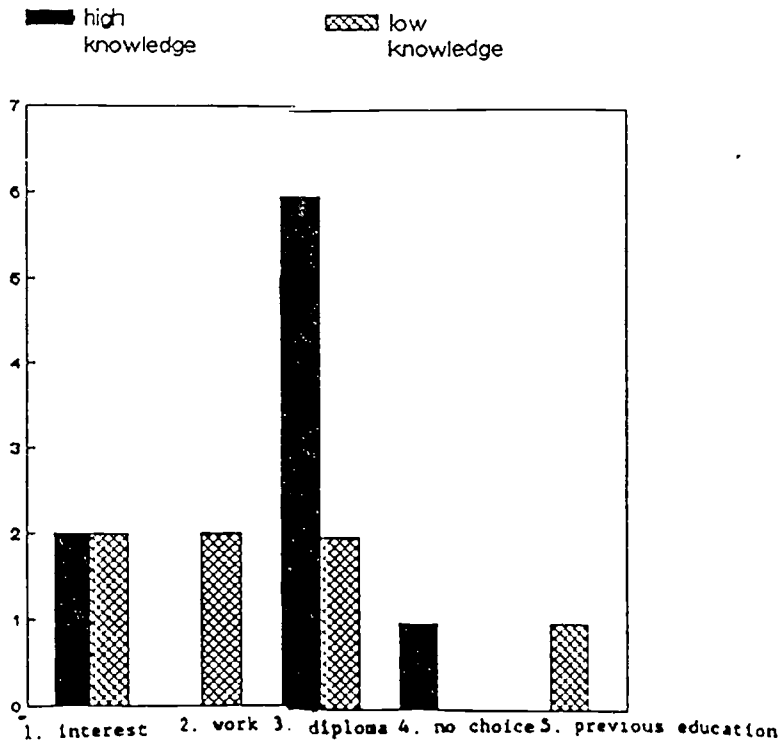


Figure 2:
Comments on the objective/motivation in terms of high/low knowledge group.

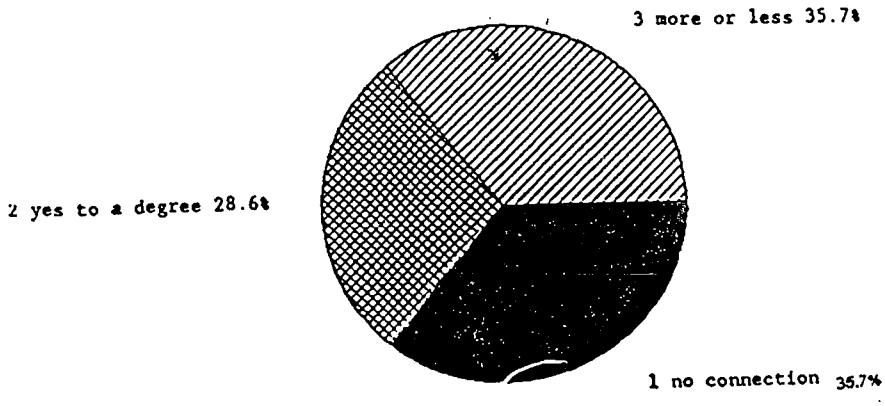


4.2. Relationship of the course to the real world.

Students were asked if they found the courses that they took related to their work / hobby / experience. Of the total research population (figure 3) a third of the students agreed that this was the case (28.6%), 35.7% of de students thought there was no connection and for 35.7% of the students there was more or less connection (35.7%).

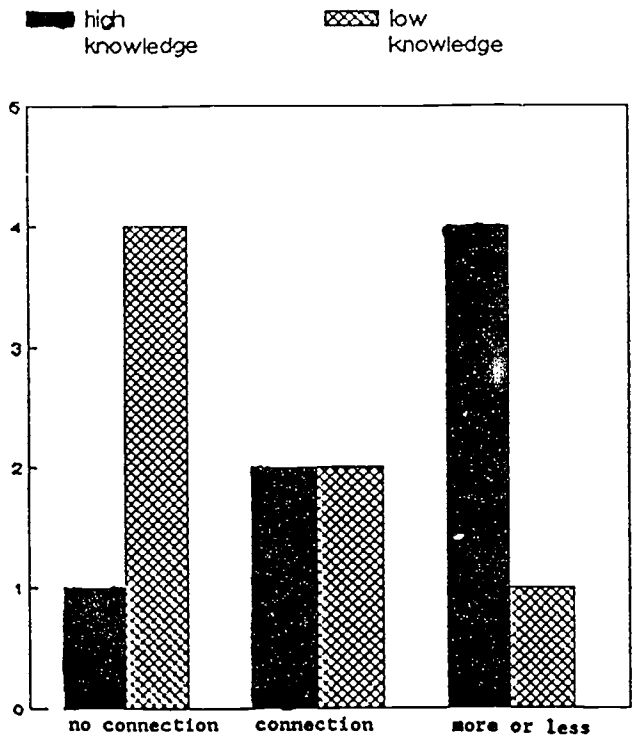
Figure 3:
Judgement of respondents on the relationship of the course to their work/hobby/experience.

more or less 35.7%
yes to a degree 28.6%
no connection 35.7%



In figure 4 the answer to these questions is broken down into the HK group and the LK group. This revealed that more than the half of the LK group found that the course that they were following did not relate to their work / hobby / experience. More than half of the HK group students found, however, that there was some sort of connection between the course that they were following and their work / hobby / experience.

Figure 4:
Connection work/hobby/experience to the course for high/low knowledge group.



4.3. Degree of difficulty.

Questions to the students as to whether they found the course difficult or easy, provided few impressive results for the research group (figure 5).
Analysis in terms of the HK and the LK group (figure 6) however, show a clear distinction. The majority of the HK group students found the course easy, whereas the opinions of the LK group students were divided. This assumption supports the general results of research into prior knowledge and the fundamental issue for the different Prior Knowledge theories, i.e. that student prior knowledge makes learning easier.
In this interpretation, the earlier limited conceptualization of prior knowledge in terms of education and work experience is assumed. Something more than the half of the LK students found the course difficult and the remaining students found it easy.

Figure 5:
Judgement of respondents on the degree of difficulty of the course.

1. very difficult
2. difficult
3. difficult/easy
4. easy
5. very easy

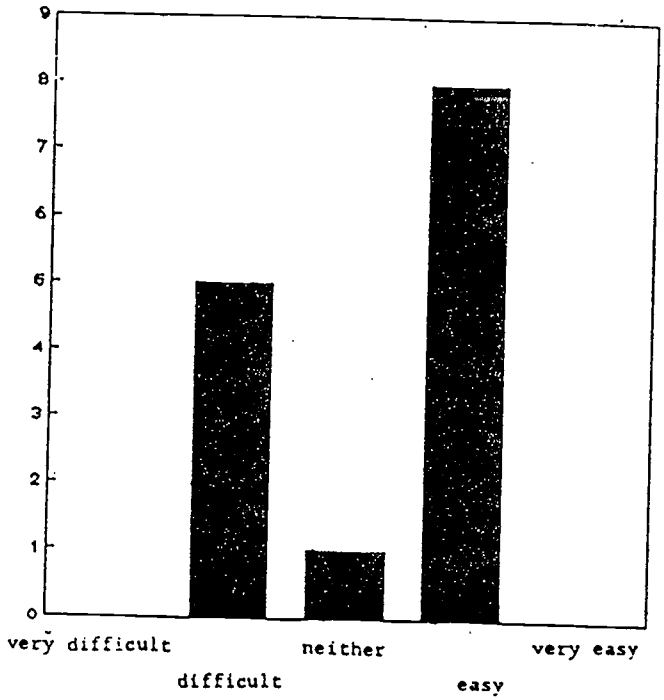
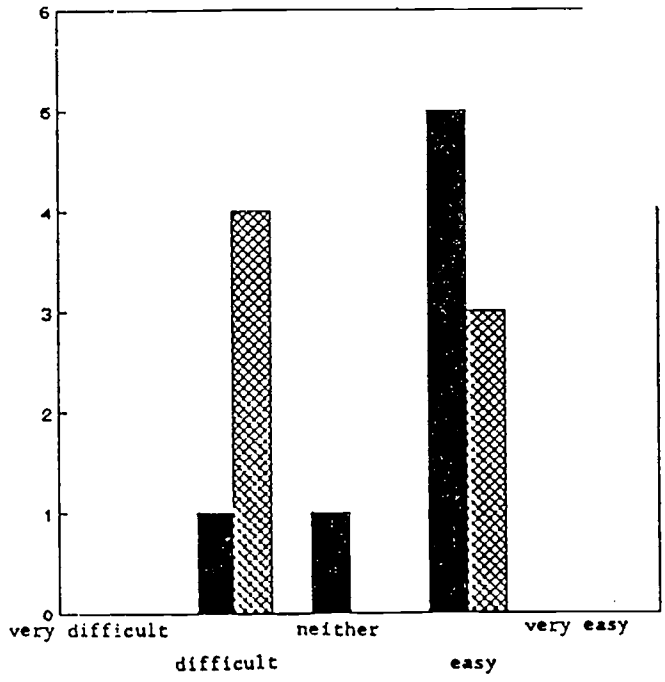


Figure 6:
The degree of difficulty of a course in terms of high/low knowledge group.

high knowledge low knowledge

1. very difficult
2. difficult
3. difficult/easy
4. easy
5. very easy



The students who found their course difficult were asked why this was so. They found it difficult for one or more of the following reasons: the course included a great deal of new material, they had forgotten a lot, the course was boring, not very nice and difficult to read and/or because of the academic language used in the course.
It is striking that the arguments 'lot of new material' or 'they had forgotten a lot' score highest (figure 7). Precisely these arguments relate best to the hypothesis that 'there is no prior knowledge'.
The reason(s) why students found their course easy were because the material was not new to them; the course provided theoretical support for generally well known aspects, the course related well to other courses, it was not a very profound course, it was clearly written with many examples, the course was well graded and had a clear structure and sufficient revision options. These reasons point one way or another to the role of prior knowledge. The students who found their course easy (primarily HK students) gave as a primary reason the fact that the course was not new to them (36.4%). Figure 8 gives a synopsis of this argument used by the HK group largely to legitimate the assessment 'the course was easy'.

Figure 7:
Comments of respondents over why course is difficult.

1. new material
2. forgotten
3. boring
4. academic language
5. difficult
6. expansion

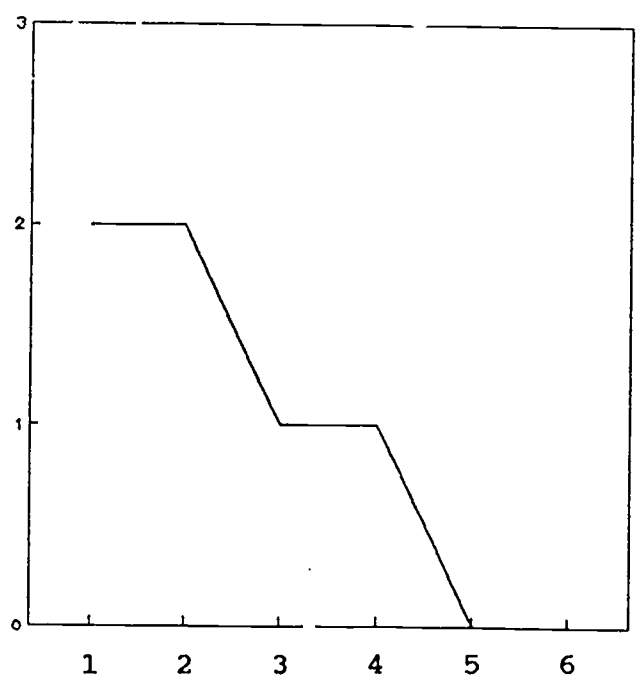
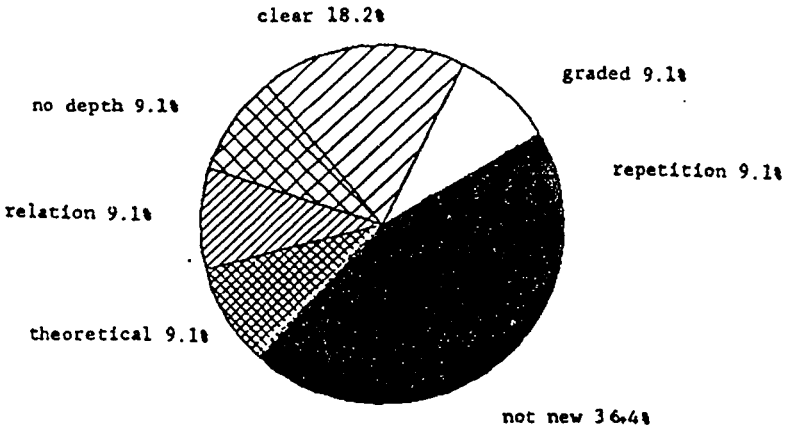


Figure 8:
Comments from respondents on why a course was easy.

clear 18.2%
no depth 9.1%
relation 9.1%
theoretical 9.1%
graded 9.1%
repetition 9.1%
not new 36.4%



4.4. Knowing what and knowing how.

The students were asked, in view of their experience of the course thus far, what a person should "know" or "know how to do" before starting the course. Under "knowing what" we understood: educational level, science subjects, OU foundation course, and under "knowing how" we included: logical thinking, practical experience, working with figures, skills.
The majority of the students felt that prospective students primarily required a knowledge of facts before they started on a OU course and to a lesser degree that they needed work experience (figure 9). Three students felt that you should not need any prerequisite for a course because anyone could do it: this depends of course on the course and the level.
The students who felt that knowledge of facts was a prime prerequisite felt that factual knowledge was desirable, and to a lesser degree a necessity (figure 10).

Figure 9:
Comments of students on what prospective students should know or know how.

1. know
2. know how
3. work experience
4. nothing necessary

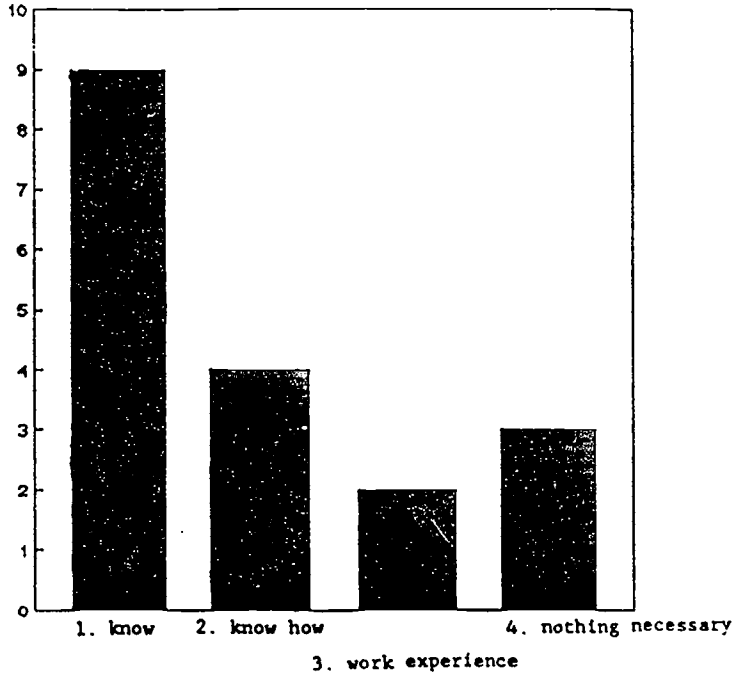
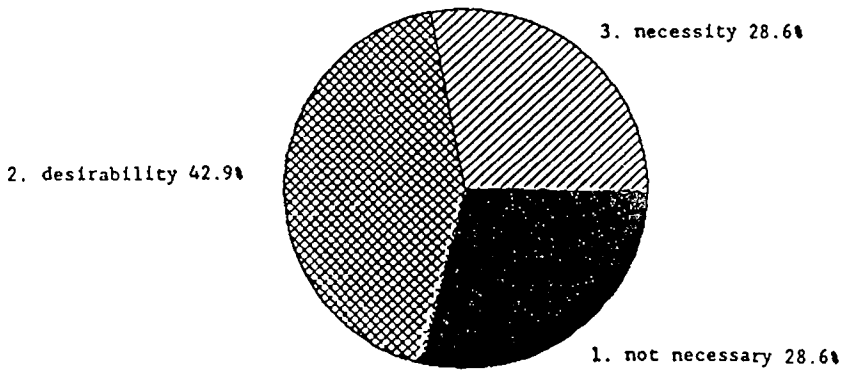


Figure 10:
Responses on the desirability/necessity of factual knowledge.

desirability 42.9%
necessity 28.6%
not necessary 28.6%



The manner in which this knowledge can best be acquired, in the view of the students, is illustrated in figure 11. Students still assign a dominant role in the transfer of knowledge to the school. When this is broken down into the HK and the LK groups, it appears that traditional views of the acquisition of knowledge are strongest among those with the most formal education (figure 12). The LK group believes that it can also derive knowledge from self study and experience.

Figure 11:
Statements by respondents on the knowledge acquisition options.

1. self study
2. experience of life
3. formal education

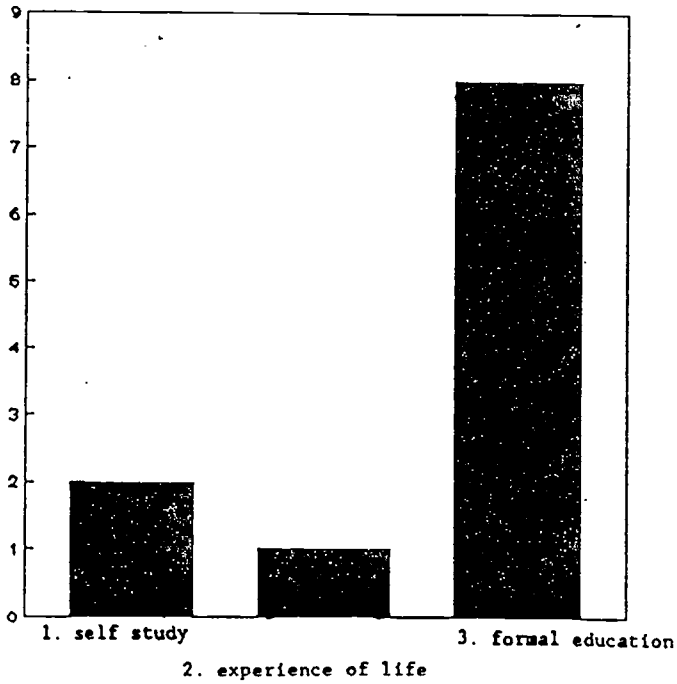
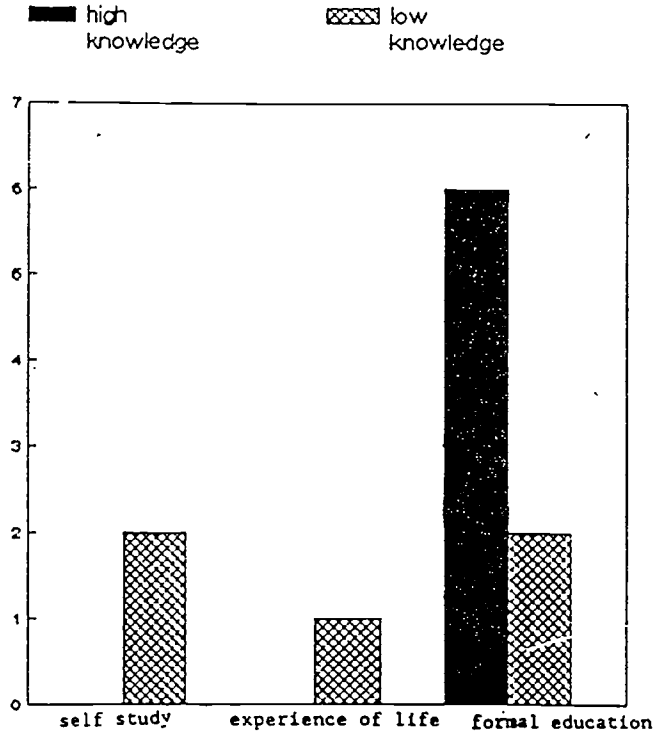


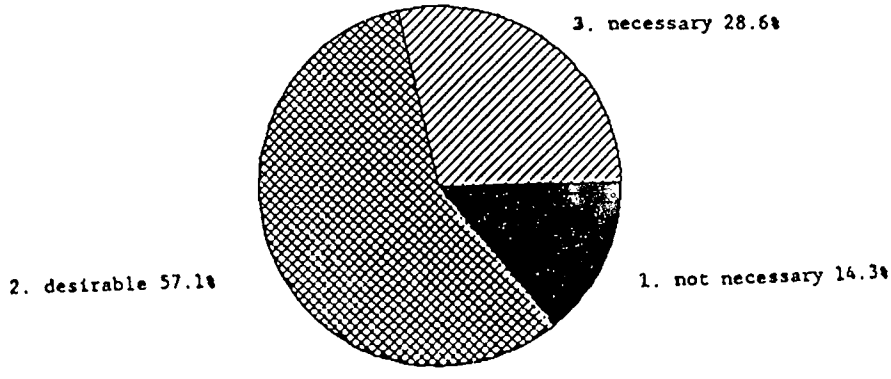
Figure 12:
Options for knowledge acquisition for the high/low knowledge group respectively.



Students who felt that prospective students must primarily know how to do something to be able to follow an OU course indicated that this ability was desirable rather than necessary (figure 13).

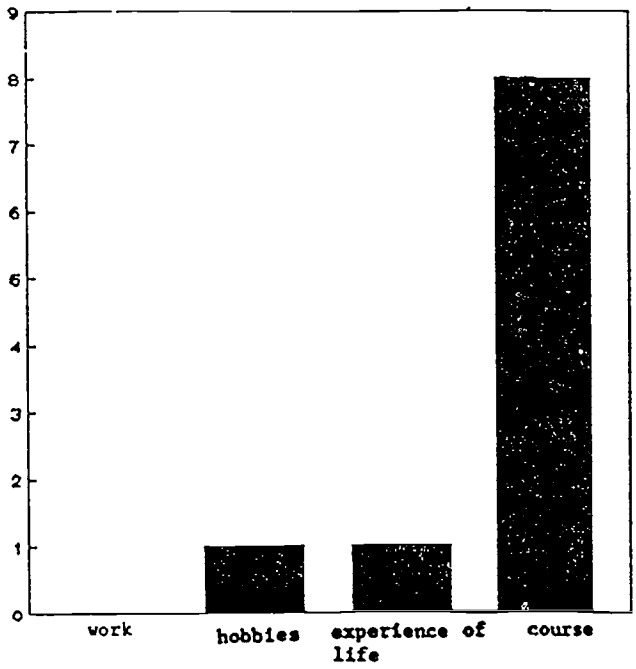
Figure 13:
The judgments of respondents on the desirability/need for skills.

desirable 57.1%
necessary 28.6%
not necessary 14.3%



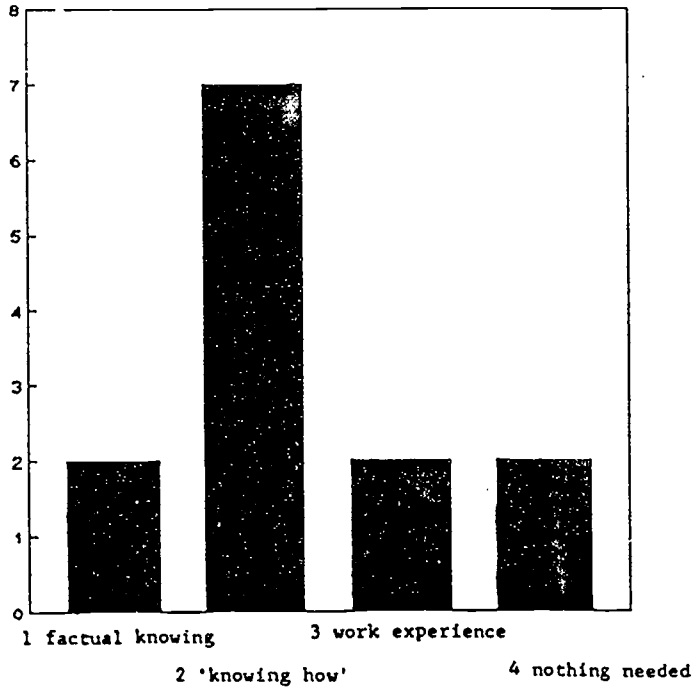
There is an analogy here with views on factual knowledge, it is claimed that knowing how is the result of taking several courses and to a lesser degree of hobbies or experience of life (figure 14).

Figure 14:
Comments by respondents on how skills may be acquired.



In the first instance, students believe that you need primarily "to know" facts in order to take an OU course. However, when questioned further many students appeared to find "knowing how" important. On further questioning, the opinion of students on factual knowledge versus "knowing how" appeared to change considerably. Compare figure 9 and 15. In the second instance knowing how gained pride of place.

Figure 15:
Statements by respondents after further questions on desirability of factual knowing and 'knowing how'.



4.5. Prior Knowledge requirements.

In one of the earlier questions students were able to give their view of what a person should know/or 'know how' in order to take a course and the relative importance they assigned to this. In fact they indicated their own "prior knowledge requirements". In response to the question as to whether they themselves met these "prior knowledge requirements" each person answered in the affirmative.
In answer to the question as to what effect not having the "prior knowledge" would have on the time required for the course, virtually every student answered that the course would take longer (figure 16).

A related question was put on what influence not having prior knowledge had on the result of the course. Most students felt that, where there was sufficient motivation and time, etc. the course could be passed. Four students found that not having the prior knowledge requirement would in fact affect their course results i.e., lower score would be achieved in the examination and it would be easier to fail (figure 17). Both figures given below show that the variable "time" plays an important role.

Figure 16:The influence of the non-possession of "prior knowledge requirements" on the time taken for the course.

2 longer 92.9% 3 no effect 7.1%

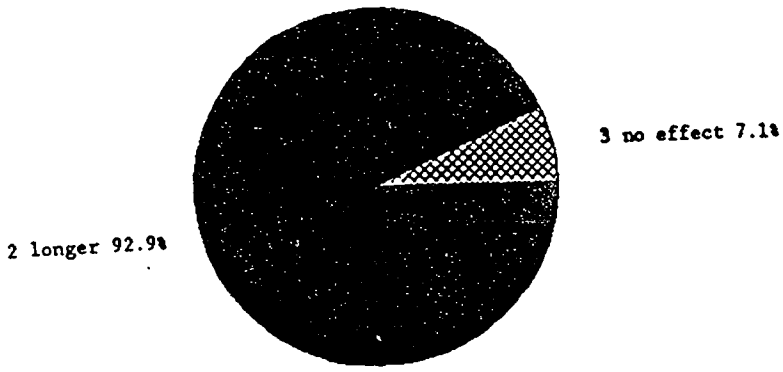
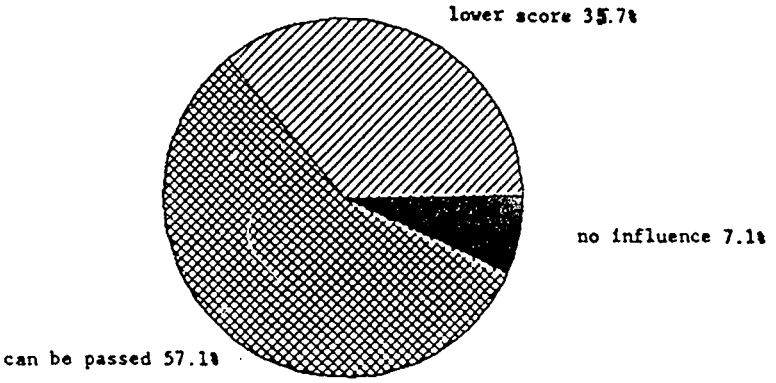


Figure 17: The effect of not possessing "prior knowledge requirements" on the results of study

lower score 36.7%
no influence 7.1%
can be passed 57.1%



4.6. Course orientation booklet (COB)

By means of the COB the student can see for himself what the global content of the course is and the prior knowledge that is assumed. Some COBs allow the student to test his/her prior knowledge to see whether they have the required entry level.
Figure 18 gives the answers to the question of whether the COB has been read. This reveals that few students among the entire research population actually looked at the COB. When students are divided into HK and LK groups (figure 19) we see that fewer students in the HK group have looked at the COB. The LK group shows a number of students did not realize that the COB existed.

Figure 18:
Comments of the respondents on their perusal of the COB

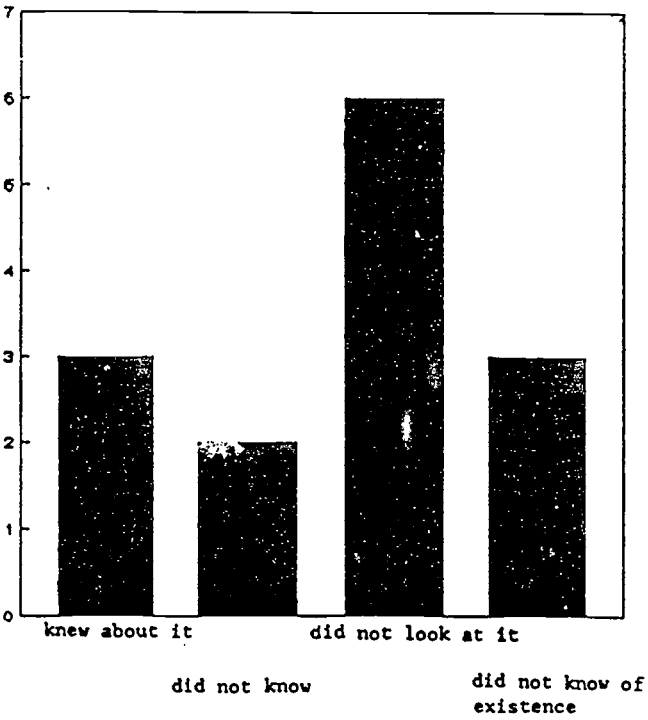
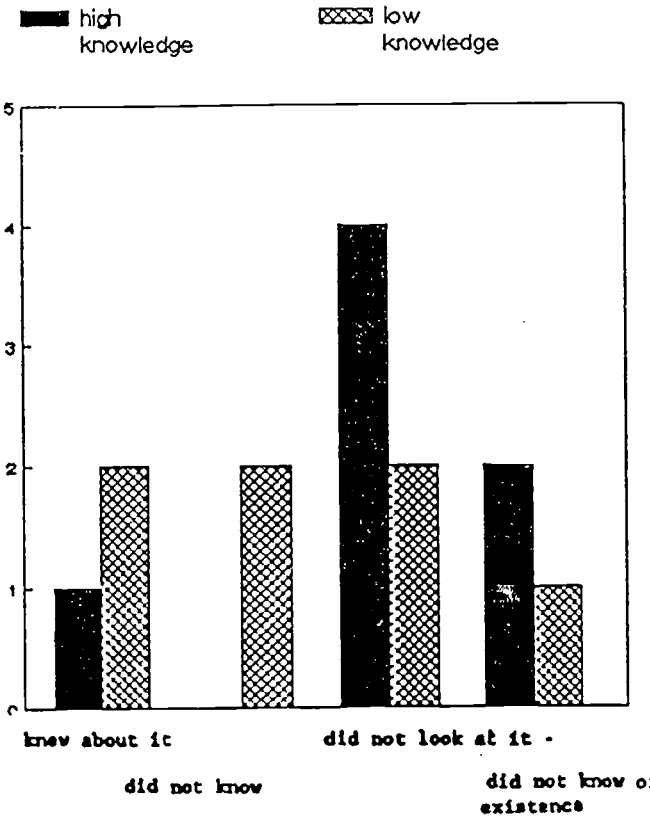


Figure 19:
Statements on examination of the COB for high/low knowledge groups.

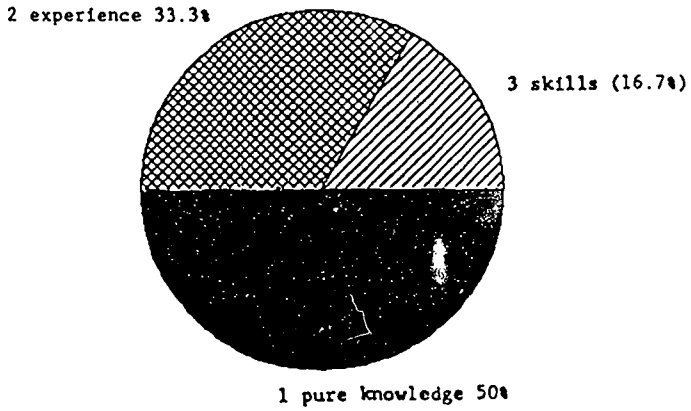


In response to the question as to why the COB was not studied, the students said that they believed that they had the required knowledge for the course.
The students who did look at the COB did not agree on the prior knowledge requirements given. Some of them found that they were a good reflection of the level of the difficulty of the course and a number of students felt that the prior knowledge requirements in the COB were too high in view of the level of the course; and some that prior knowledge requirements were too easy in view of the course level.

4.7. Prior Knowledge.

The students were asked what they understood by "prior knowledge". Figure 20 shows that they defined "prior knowledge" as pure knowledge (50%), experience (33.3%) and skills (16.7%). On being questioned further there was a significant change in the pattern of answers. Skills (22.2%) and experience (22.2%) were then equal.

Figure 20:
Statements by the respondents on the
meaning of the concept of prior knowledge



Differences in perception of "prior knowledge" between the LK group and the HK group are given in figure 21.
This shows that both HK and LK students understand pure knowledge as part of prior knowledge. It is striking that the LK group of students find experience an important part of prior knowledge, while for the HK group skills are an important part of prior knowledge.
Students were also asked to award themselves an entry score

for their prior knowledge before they began the course. All students gave themselves a pass on this because they believed that they had enough prior knowledge to be able to follow the course.
This shows that the students have no access to and no insight into their own PKS level. They are not able to give a real assessment of their prior knowledge.

Figure 21:
Definition of the concept prior knowledge
in terms of high/low knowledge group

5. Conclusion

There is a brief reflection on the results in respect of each research objective.

5.1. Differences between perceived prior knowledge of students and prior knowledge variables that can be ascertained.

Perceived prior knowledge in the strict sense, in particular, assigning a grade to one self for one's prior knowledge, produces virtually no differences between the students. They generally gave themselves a C- or a C+, depending on what had been ascertained from previous education and work experience. Students did not appear to be able to perceive their prior knowledge in this way. Furthermore it appeared from the further questions in the interview that the students could be brought to a very different view of PKS in a short period of time.

5.2. The opinion of students and of experts on the concept of "prior knowledge".

From research among experts in cognitive psychology and artificial intelligence (research report 2), it appeared that the concept of "prior knowledge state" was defined as acquired information and skills (declarative and procedural) and experience. In this study it appeared that among students these three components were detectable, with the accent on pure knowledge (information) (50% to 55%), in addition to experience (22.2% to 33.3%) and skills (16.7% to 22.2%).
It should be added that a part of the information and skills can be characterized as experience. The distinction resides in the source - a part of the PKS is a result of experience- or in the intention - in addition to intentional learning, experience is largely seen as incidental learning. As such it is not entirely formalized in the form of diplomas or certificates.

5.3. The opinion of students on the connections between the courses and their prior knowledge and experience.

The conclusion that those students who found the course easy came largely from the HK group and that they indicated the course was not entirely new to them, shows that the subjective judgment of the students on the connection between their knowledge/experience and the course is determined by their PKS level. Other arguments given, such as the course is a theoretical basis for generally well known aspects, the course relates well to other courses, is clearly written, is well graded, has a clear structure, has sufficient revision

options - were also supported by various prior knowledge theories. What we are referring to here are the elaboration theory, the availability theory, the retrieval-aid-theory, the theory of selective attention, and other theories (research report 1).

5.4. Students on the composition of the COB and its use.

In respect of COBs it can be said that very few students from among the total research population looked at the orientation before the course. There were students among the LK group who were not even aware of its existence. The HK group knew that it existed but they made little or no use of it. They assumed that they had the required knowledge.
Opinion is divided on the prior knowledge requirements in the COBs. Some found the requirements too high, others too easy in view of the level of the course. Comments such as "the COB looks nicer than the course" and "the COB is virtually the same as chapter 1 of the course" show a great deal has been missed.

5.5. The relationship between prior knowledge (objectively ascertainable variables) and taking the course.

A hypothesis in this research was that the variables in terms of education and work experience were exponents of the students' prior knowledge (operationalized in the LK and HK groups) and were percepted in this way.
Differences between the two groups were established in respect of objectives and the motivation for study, the connection between the course and their own world (work, hobby, experience) , the degree of difficulty of the course, views on the acquisition of knowledge, the use of the COB and the conceptualization of "prior knowledge". In figure 22 the perceived qualitative differences are reproduced schematically.

Figure 22. Perceived differences between HK and LK groups

	HK-group	LK-group
Motive	Diploma	Better employement opportunity; completion or unfinished education.
Connection course	yes or more or less	None or more or less
Difficulty	Easy	Opinions divided
Acquiring knowledge	School	School/self study/experience
Use of course orientation	Less	Often not aware of its existence

This schema shows that there are indications of a confirmation of the hypothesis. In any case, it may be said that a higher level of education and more work experience leads to the students finding a closer connection between the course and the world of experience. Further, the students find the courses easier and they make less use of the COB because they assume that they have a sufficient entry level.

All of the students found the entry level important. Not meeting prior knowledge requirements had negative consequences for the length of the programme and the results: the course would in any case will last longer and furthermore more motivation would be necessary to pass the course or it would be easier to fail. The "time" variable appears to play an important role in this.

6. In summary

This qualitative preliminary research of an exploratory character gives a number of directions for further research. The proposed conceptual model with reference to the prior knowledge state seems to be a feasible from the point of view of the student. There are indications that the objectively ascertainable variables "prior education" and "work experience" give an indication of prior knowledge. Their place within the conceptual model for PKS research appears to be justified. The "time" variable appears to be more important and must be introduced into the model.
Furthermore, it would appear not to make much sense to allow the students to assess their prior knowledge themselves. This method appears subjective and not feasible for further research.

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